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TI Metal-coated **copper** alloy electric conductor for winding
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AB The conductor consists of a **Cu** alloy material contg. Sn, Ag, Ni, **Zn**, **Mg**, Cr, and/or Zr coated with .gtoreq.1 material selected from Au, Ag, **Cu**, Sn, Sn-Pb alloy, Pb, Ni, Cr, Zr, and Al. The conductor is useful for liq. fuel-spray devices of automobiles, etc. The conductor showed good temp. coeff. of elec. resistance and corrosion resistance.

PATENT ABSTRACTS OF JAPAN

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(54) CONDUCTOR FOR COIL

(57)Abstract:

PURPOSE: To provide a conductor for the coil of a liquid fuel injection system which is used inside liquid fuel, having good conductivity and a good electric resistance temperature coefficient and excellent corrosion resistance.

CONSTITUTION: A copper alloy core containing at least one kind of metal selected from Sn, Ag, Ni, Zn, Mg, Cr, and Zr and the rest Cu is covered with a cover material made from at least one kind of metal selected from Au, Ag, Cu, Sn, Sn-Pb alloy, Pb, Ni, Cr, Zr, and Al.

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CLAIMS

[Claim(s)]
[Claim 1] the object for coils characterized by covering the covering material which consists of at least one sort in Au, Ag, Cu, Sn, a Sn-Pb alloy, and Pb, nickel, Cr, Zr and aluminum to the copper alloy core material which at least one sort in Sn, Ag, nickel, Zn, Mg, Cr, and Zr is contained, and the remainder becomes from Cu substantially -- a conductor
[Claim 2] the object for coils according to claim 1 using the copper alloy which contained Zn:15 - 40wt% as a core material -- a conductor

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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] the object for coils by which this invention is used for liquid fuel fuel injection equipments, such as an automobile, -- electric resistance, an electric resistance temperature coefficient, and corrosion resistance are especially improved about a conductor
[0002]
[Description of the Prior Art] Conventionally, the pure-copper line by which the coil of the coil for electromagnets of liquid fuel fuel injection equipments, such as a gasoline and alcohol, was covered with insulators, such as an enamel, as the conductor since high conductivity was required was used. However, in spite of having asked the coil of the above-mentioned coil for a low electric resistance temperature coefficient and thermal resistance from the request of low mpg etc. recently, the pure copper was a problem also that the temperature coefficient of electric resistance is large, and in respect of thermal resistance.
[0003] Therefore, though some conductivity was made into the sacrifice, use of a heat-resistant good copper alloy with the small temperature coefficient of electric resistance could be considered, and 65 / 35 brass lines have been used from the former. However, when the coil coil with which a copper alloy generally has risk of stress corrosion cracking occurring depending on conditions, and voltage was impressed by the operation of the moisture of the minute amount in the above-mentioned liquid fuel was used for a long time, corrosion sometimes occurred in the conductor, and when remarkable, it might result in the open circuit. That is, above-mentioned 65 / 35 brass lines had a problem in respect of corrosion resistance, such as a stress corrosion.
[0004]
[Means for Solving the Problem] the object for coils with the still better corrosion resistance in the inside of liquid fuel [in / an energization state / this invention is variously excellent in conductivity and electric resistance temperature dependence in view of this as a result of examination, and] -- a conductor is offered
[0005] Namely, this invention contains at least one sort in Sn, Ag, nickel, Zn, Mg, Cr, and Zr. It is what is characterized by covering the covering material which consists of at least one sort in Au, Ag, Cu, Sn, a Sn-Pb alloy, and Pb, nickel, Cr, Zr and aluminum to the copper alloy core material which the remainder becomes from Cu substantially. It is good to use the copper alloy which contained Zn:15 - 40wt% as a core material.
[0006]
[Function] Thus, this invention is the composition which made the core material the copper alloy excellent in the electric resistance temperature coefficient, and made covering material a metal or an alloy excellent in the corrosion resistance in the inside of liquid fuel.
[0007] As a core material, 3 yuan alloys, such as a Cu-Zn-Mg alloy besides [, such as an Cu-Sn alloy, an Cu-Ag alloy, a Cu-nickel alloy, a Cu-Zn alloy, a Cu-Cr alloy, and a Cu-Zr alloy,] a 2 yuan alloy and a Cu-Cr-Zr alloy, can also be used in more detail. And as for the content of these alloying elements, it is desirable that it is more than 0.15wt%. In addition, in order to reduce an electric resistance temperature coefficient greatly as a core material, without reducing conductivity not much, corrosion resistance and processability are also taken into consideration and a Cu-15-40wt%Zn alloy is the most desirable.
[0008] Moreover, you may be the alloy which consists of two or more sorts, the above-mentioned metal or an alloy, as covering material. The expected effect is still more eternal, even if electroplating, hot dipping, etc. may be what methods and these have diffused mutually the covering method to the core material of covering material in the interface of a core material and covering material.
[0009]

[Example] An example explains this invention in detail below.
[0010] (Example 1) The usual dissolution casting, extrusion, rolling, annealing, and wire drawing are performed to the copper alloy of the composition shown in Table 1, and it is a diameter, respectively. The 0.3mm wire rod was obtained. subsequently, a metal or an alloy as shown in these wire rods in Table 1 -- covering material -- carrying out -- either electroplating or hot dipping -- the thickness of 2 micrometers -- covering -- the object for coils -- the conductor was obtained and these conductors -- a top -- 0.015mm in thickness The coil for electromagnets of a motor-spirit injection valve was made using the wire rod which gave enamel covering, and the fuel injection valve which incorporated this coil further was produced.
[0011]
[Table 1]

導体 conductor	No	芯材組成 (wt%)								被覆材	
		Sn	Ag	Ni	Zn	Mg	Cr	Zr	Cu	種類	メッキ方法
本発明導体	1	0.3	—	—	—	—	—	—	残	Ni	電気
〃	2	0.7	—	—	—	—	—	—	〃	Ag	〃
〃	3	—	2.0	—	—	—	—	—	〃	Sn	溶融
〃	4	—	—	0.25	—	—	—	—	〃	Sn	〃
〃	5	—	—	0.3	—	—	—	—	〃	Cr	電気
〃	6	—	—	—	0.2	0.2	—	—	〃	Sn−Pb	溶融
〃	7	—	—	—	—	—	1.0	—	〃	Pb	〃
〃	8	—	—	—	—	—	—	0.4	〃	Au	電気
〃	9	—	—	—	—	—	0.8	0.2	〃	Sn−Pb	溶融
〃	10	0.15	—	—	—	—	—	—	〃	Sn	〃
比較導体	11	0.3	—	—	—	—	—	—	〃	なし	
〃	12	—	—	0.25	—	—	—	—	〃	〃	
従来導体	13	純銅								なし	

[0012] The life test to an open circuit of the wire rod which was made to energize in moisture 1%+ alcoholic 30%+ gasoline 69% fuel, and was used for the coil was performed using the above-mentioned fuel injection valve. It tested by keeping the temperature of fuel at 80 degrees C in order to accelerate corrosion at this time. This result was shown in Table 2. In addition, although the O ring was formed in order that the conventional fuel injection valve might prevent fuel invasion in the coil section, the coil might be dipped into fuel according to aggravation of the seal nature of this O ring. Then, the fuel injection valve of the type with which fuel invades into the coil section in this example was used. And conductivity and the electric resistance temperature coefficient were measured by the usual method about the wire rod used for these coils, and those results were shown in Table 2.
[0013] moreover, the object for the coils before the above-mentioned enamel covering -- the open wire which is a conductor is made to energize in moisture 1%+ alcoholic 30%+ gasoline 69% liquid fuel -- the corrosion weight loss after progress was measured on the 120th In addition, in order to accelerate corrosion at this time, the temperature of liquid fuel was kept being the same as that of the above at 80 degrees C. This result is also shown in Table 2.
[0014]
[Table 2]

導　体	No.	導　電　率 (%IACS)	電気抵抗温度係数 ($℃^{-1}$)	断線までの寿　命 (hr)	裸線の腐食減　量 (%)
本発明導体	1	80	0.0028	4200	＜1
〃	2	72	0.0026	5200	〃
〃	3	89	0.0030	3800	〃
〃	4	70	0.0026	5200	〃
〃	5	65	0.0025	5400	〃
〃	6	76	0.0027	4800	〃
〃	7	85	0.0029	4000	〃
〃	8	77	0.0027	4900	〃
〃	9	86	0.0029	4200	〃
〃	10	88	0.0030	3900	〃
比較導体	11	80	0.0028	2300	7
〃	12	70	0.0026	2500	8
従来導体	13	100	0.0039	1300	5

[0015] clear from Table 2 -- as -- the object for the coils of this invention -- a conductor -- the former which each No.1-No.10 becomes from a pure copper -- a conductor -- although some conductivity is inferior as compared with No.13, an electric resistance temperature coefficient is small, and it turns out that it has the outstanding corrosion resistance on the other hand, comparison which does not cover -- a conductor -- it is clear that No.12 [No.11 and / especially] corrosion resistance is inferior

[0016] (Example 2) The usual dissolution casting, extrusion, rolling, annealing, and wire drawing are performed to the copper alloy of the composition shown in Table 3, and it is a diameter. The 0.3mm wire rod was obtained. Subsequently, the covering material shown in these wire rods in Table 3 was covered in thickness of 2 micrometers, it processed like the example 1 below, the coil for electromagnets of a motor-spirit injection valve was made, and the fuel injection valve which incorporated this coil further was produced.

[0017]

[Table 3]

導　体	No.	芯材組成（wt%）		被覆材	
		Ｚｎ	Ｃｕ	種　類	メッキ方法
本発明導体	１４	１０	残	Ｃｕ	電　気
〃	１５	１５	〃	〃	〃
〃	１６	２０	〃	Ｓｎ	溶　融
〃	１７	〃	〃	Ｃｒ	電　気
〃	１８	２５	〃	Ｚｒ	〃
〃	１９	３０	〃	Ａｕ	〃
〃	２０	〃	〃	Ｓｎ－Ｐｂ	溶　融
〃	２１	３５	〃	Ｓｎ	電　気
〃	２２	〃	〃	Ｐｂ	溶　融
〃	２３	〃	〃	Ｃｕ	電　気
〃	２４	〃	〃	Ｎｉ	〃
〃	２５	４０	〃	Ａｇ	〃
従来導体	２６	６５／３５黄銅		なし	

[0018] The life test of a wire rod was performed like the example 1 using the above-mentioned fuel injection valve, and the conductivity of these wire rods and the temperature coefficient of electric resistance were measured, the corrosion weight loss of the open wire before enamel covering of these wire rods was further measured like the example 1, and these results were shown in Table 4.

[0019]

[Table 4]

導　体	No.	導　電　率 (%IACS)	電気抵抗温度係数 ($℃^{-1}$)	断線までの寿　命 (hr)	裸線の腐食減　量 (%)
本発明導体	１４	４５	０．００２１	６０００	＜１
〃	１５	３７	０．００１８	７１００	〃
	１６	３２	０．００１７	７８００	〃
〃	１７	〃	〃	８０００	０
〃	１８	３０	〃	８７００	〃
〃	１９	２８	０．００１６	９４００	〃
〃	２０	〃	〃	９２００	＜１
〃	２１	２６	０．００１５	＞１００００	〃
〃	２２	〃	〃	〃	〃
〃	２３	〃	〃	〃	〃
〃	２４	〃	〃	〃	０
〃	２５	２７	０．００１４	〃	〃
従来導体	２６	２６	０．００１５	５２０	９

[0020] clear from Table 4 -- as -- the object for the coils of this invention -- a conductor -- the former which

No.14-No.25 become from 65/35 brass -- a conductor -- comparing -- conductivity and an electric resistance temperature coefficient -- equivalent -- it is also -- it turns out that corrosion resistance is remarkably excellent [0021]

[Effect of the Invention] thus, the object for coils which was excellent in conductivity, an electric resistance temperature coefficient, and corrosion resistance according to this invention -- a conductor is obtained and the device life of a liquid fuel fuel injection equipment can be improved further -- the object for the coils of this invention -- a conductor has the effect of being able to offer a highly efficient and long lasting device, if it uses as a coil, terminal material for electric supply, terminal plate material, etc. of the motor for an in tank type fuel pump drive

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[Translation done.]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] the object for coils by which this invention is used for liquid fuel fuel injection equipments, such as an automobile, -- electric resistance, an electric resistance temperature coefficient, and corrosion resistance are especially improved about a conductor

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[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] thus, the object for coils which was excellent in conductivity, an electric resistance temperature coefficient, and corrosion resistance according to this invention -- a conductor is obtained and the device life of a liquid fuel fuel injection equipment can be improved further -- the object for the coils of this invention -- a conductor has the effect of being able to offer a highly efficient and long lasting device, if it uses as a coil, terminal material for electric supply, terminal plate material, etc. of the motor for an in tank type fuel pump drive

[Translation done.]

TECHNICAL PROBLEM

[Description of the Prior Art] Conventionally, the pure-copper line by which the coil of the coil for electromagnets of liquid fuel fuel injection equipments, such as a gasoline and alcohol, was covered with insulators, such as an enamel, as the conductor since high conductivity was required was used. However, in spite of having asked the coil of the above-mentioned coil for a low electric resistance temperature coefficient and thermal resistance from the request of low mpg etc. recently, the pure copper was a problem also that the temperature coefficient of electric resistance is large, and in respect of thermal resistance.
[0003] Therefore, though some conductivity was made into the sacrifice, use of a heat-resistant good copper alloy with the small temperature coefficient of electric resistance could be considered, and 65 / 35 brass lines have been used from the former. However, when the coil coil with which a copper alloy generally has risk of stress corrosion cracking occurring depending on conditions, and voltage was impressed by the operation of the moisture of the minute amount in the above-mentioned liquid fuel was used for a long time, corrosion sometimes occurred in the conductor, and when remarkable, it might result in the open circuit. That is, above-mentioned 65 / 35 brass lines had a problem in respect of corrosion resistance, such as a stress corrosion.

[Translation done.]

* NOTICES *

MEANS

[Means for Solving the Problem] the object for coils with the still better corrosion resistance in the inside of liquid fuel [in / an energization state / this invention is variously excellent in conductivity and electric resistance temperature dependence in view of this as a result of examination, and] -- a conductor is offered [0005] Namely, this invention contains at least one sort in Sn, Ag, nickel, Zn, Mg, Cr, and Zr. It is what is characterized by covering the covering material which consists of at least one sort in Au, Ag, Cu, Sn, a Sn-Pb alloy, and Pb, nickel, Cr, Zr and aluminum to the copper alloy core material which the remainder becomes from Cu substantially. It is good to use the copper alloy which contained Zn:15 - 40wt% as a core material.

[Translation done.]

OPERATION

[Function] Thus, this invention is the composition which made the core material the copper alloy excellent in the electric resistance temperature coefficient, and made covering material a metal or an alloy excellent in the corrosion resistance in the inside of liquid fuel.
[0007] As a core material, 3 yuan alloys, such as a Cu-Zn-Mg alloy besides [, such as an Cu-Sn alloy, an Cu-Ag alloy, a Cu-nickel alloy, a Cu-Zn alloy, a Cu-Cr alloy, and a Cu-Zr alloy,] a 2 yuan alloy and a Cu-Cr-Zr alloy, can also be used in more detail. And as for the content of these alloying elements, it is desirable that it is more than 0.15wt%. In addition, in order to reduce an electric resistance temperature coefficient greatly as a core material, without reducing conductivity not much, corrosion resistance and processability are also taken into consideration and a Cu-15-40wt%Zn alloy is the most desirable.
[0008] Moreover, you may be the alloy which consists of two or more sorts, the above-mentioned metal or an alloy, as covering material. The expected effect is still more eternal, even if electroplating, hot dipping, etc. may be what methods and these have diffused mutually the covering method to the core material of covering material in the interface of a core material and covering material.

[Translation done.]

EXAMPLE

[Example] An example explains this invention in detail below.
[0010] (Example 1) The usual dissolution casting, extrusion, rolling, annealing, and wire drawing are performed to the copper alloy of the composition shown in Table 1, and it is a diameter, respectively. The 0.3mm wire rod was obtained. subsequently, a metal or an alloy as shown in these wire rods in Table 1 -- covering material -- carrying out -- either electroplating or hot dipping -- the thickness of 2 micrometers -- covering -- the object for coils -- the conductor was obtained and these conductors -- a top -- 0.015mm in thickness The coil for electromagnets of a motor-spirit injection valve was made using the wire rod which gave enamel covering, and the fuel injection valve which incorporated this coil further was produced.
[0011]
[Table 1]

導体	No	芯材組成 (wt%)								被覆材	
		Sn	Ag	Ni	Zn	Mg	Cr	Zr	Cu	種類	メッキ方法
本発明導体	1	0.3	—	—	—	—	—	—	残	Ni	電気
〃	2	0.7	—	—	—	—	—	—	〃	Ag	〃
〃	3	—	2.0	—	—	—	—	—	〃	Sn	溶融
〃	4	—	—	0.25	—	—	—	—	〃	Sn	〃
〃	5	—	—	0.3	—	—	—	—	〃	Cr	電気
〃	6	—	—	—	0.2	0.2	—	—	〃	Sn−Pb	溶融
〃	7	—	—	—	—	—	1.0	—	〃	Pb	〃
〃	8	—	—	—	—	—	—	0.4	〃	Au	電気
〃	9	—	—	—	—	—	0.3	0.2	〃	Sn−Pb	溶融
〃	10	0.15	—	—	—	—	—	—	〃	Sn	〃
比較導体	11	0.3	—	—	—	—	—	—	〃	なし	
〃	12	—	—	0.25	—	—	—	—	〃	〃	
従来導体	13	純銅								なし	

[0012] The life test to an open circuit of the wire rod which was made to energize in moisture 1%+ alcoholic 30%+ gasoline 69% fuel, and was used for the coil was performed using the above-mentioned fuel injection valve. It tested by keeping the temperature of fuel at 80 degrees C in order to accelerate corrosion at this time. This result was shown in Table 2. In addition, although the O ring was formed in order that the conventional fuel injection valve might prevent fuel invasion in the coil section, the coil might be dipped into fuel according to aggravation of the seal nature of this O ring. Then, the fuel injection valve of the type with which fuel invades into the coil section in this example was used. And conductivity and the electric resistance temperature coefficient were measured by the usual method about the wire rod used for these coils, and those results were shown in Table 2.
[0013] moreover, the object for the coils before the above-mentioned enamel covering -- the open wire which is a conductor is made to energize in moisture 1%+ alcoholic 30%+ gasoline 69% liquid fuel -- the corrosion

weight loss after progress was measured on the 120th In addition, in order to accelerate corrosion at this time, the temperature of liquid fuel was kept being the same as that of the above at 80 degrees C. This result is also shown in Table 2.

[0014]

[Table 2]

導体	No.	導電率 (%IACS)	電気抵抗温度係数 ($℃^{-1}$)	断線までの寿命 (hr)	裸線の腐食減量 (%)
本発明導体	1	80	0.0028	4200	＜1
〃	2	72	0.0026	5200	〃
〃	3	89	0.0030	3800	〃
〃	4	70	0.0026	5200	〃
〃	5	65	0.0025	5400	〃
〃	6	76	0.0027	4800	〃
〃	7	85	0.0029	4000	〃
〃	8	77	0.0027	4900	〃
〃	9	86	0.0029	4200	〃
〃	10	88	0.0030	3900	〃
比較導体	11	80	0.0028	2300	7
〃	12	70	0.0026	2500	8
従来導体	13	100	0.0039	1300	5

[0015] clear from Table 2 -- as -- the object for the coils of this invention -- a conductor -- the former which each No.1-No.10 becomes from a pure copper -- a conductor -- although some conductivity is inferior as compared with No.13, an electric resistance temperature coefficient is small, and it turns out that it has the outstanding corrosion resistance on the other hand, comparison which does not cover -- a conductor -- it is clear that No.12 [No.11 and / especially] corrosion resistance is inferior

[0016] (Example 2) The usual dissolution casting, extrusion, rolling, annealing, and wire drawing are performed to the copper alloy of the composition shown in Table 3, and it is a diameter. The 0.3mm wire rod was obtained. Subsequently, the covering material shown in these wire rods in Table 3 was covered in thickness of 2 micrometers, it processed like the example 1 below, the coil for electromagnets of a motor-spirit injection valve was made, and the fuel injection valve which incorporated this coil further was produced.

[0017]

[Table 3]

導　体	No.	芯材組成（wt%）		被覆材	
		Zn	Cu	種　類	メッキ方法
本発明導体	14	10	残	Cu	電　気
〃	15	15	〃	〃	〃
〃	16	20	〃	Sn	溶　融
〃	17	〃	〃	Cr	電　気
〃	18	25	〃	Zr	〃
〃	19	30	〃	Au	〃
〃	20	〃	〃	Sn−Pb	溶　融
〃	21	35	〃	Sn	電　気
〃	22	〃	〃	Pb	溶　融
〃	23	〃	〃	Cu	電　気
〃	24	〃	〃	Ni	〃
〃	25	40	〃	Ag	〃
従来導体	26	65／35黄銅		なし	

[0018] The life test of a wire rod was performed like the example 1 using the above-mentioned fuel injection valve, and the conductivity of these wire rods and the temperature coefficient of electric resistance were measured, the corrosion weight loss of the open wire before enamel covering of these wire rods was further measured like the example 1, and these results were shown in Table 4.

[0019]

[Table 4]

導　体	No.	導　電　率 (%IACS)	電気抵抗温度係数 ($℃^{-1}$)	断線までの寿　命 (hr)	裸線の腐食減　量 (%)
本発明導体	14	45	0.0021	6000	＜1
〃	15	37	0.0018	7100	〃
	16	32	0.0017	7800	〃
〃	17	〃	〃	8000	0
〃	18	30	〃	8700	〃
〃	19	28	0.0016	9400	〃
〃	20	〃	〃	9200	＜1
〃	21	26	0.0015	＞10000	〃
〃	22	〃	〃	〃	〃
〃	23	〃	〃	〃	〃
〃	24	〃	〃	〃	0
〃	25	27	0.0014	〃	〃
従来導体	26	26	0.0015	520	9

[0020] clear from Table 4 -- as -- the object for the coils of this invention -- a conductor -- the former which

No.14-No.25 become from 65/35 brass -- a conductor -- comparing -- conductivity and an electric resistance temperature coefficient -- equivalent -- it is also -- it turns out that corrosion resistance is remarkably excellent

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[Translation done.]